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Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006

AMENDMENTS TO THE CLAIMS:

The listing of claims replaces all prior versions and listings of claims in the application:

LISTING OF THE CLAIMS

1. (Currently Amended) A method in a resource deallocation module of releasing resources of a user session operating in a software environment that includes an automatic memory management algorithm executed by a garbage collector, the method comprising:

using the resource deallocation module, detecting an impending execution of the automatic memory management algorithm;

responsive to the detecting, accessing, by the resource deallocation module, an object of the user session and traversing an object graph;

identifying, by the resource deallocation module, one or more external resource references of said object;

using the resource deallocation module, releasing said one or more external resource references by a set of rules for said object; and

repeating the accessing, identifying, and releasing, by the resource deallocation module, for each object of the user session.

2. (Original) The method as set forth in claim 1, further including:
performing the accessing, identifying, releasing, and repeating as a Listener method belonging to a Java MyListener class in a Java environment; and
registering the Listener method with the user session.

3. (Original) The method as set forth in claim 2, wherein the registering includes:
setting a session attribute to correspond to an instance of the Listener method.

*Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006*

4. (Original) The method as set forth in claim 2, wherein the detecting includes:

notifying the registered Listener method of the impending expiration of the user session.

5. (Original) The method as set forth in claim 1, wherein the detecting includes:

detecting an impending expiration of the user session.

6. (Original) The method as set forth in claim 1, wherein the accessing, identifying, releasing, and repeating is performed prior to the execution of the automatic memory management algorithm.

7. (Original) The method as set forth in claim 1, wherein:
the identifying includes identifying a file resource; and
the releasing includes closing said file resource.

8. (Original) The method as set forth in claim 1, wherein:
the identifying includes identifying an allocated resource; and
the releasing includes deallocating the allocated resource.

9. (Previously Presented) The method as set forth in claim 1, wherein the accessing of an object of the user session includes:

obtaining an object identifier corresponding to said object from the object graph; and
retrieving said object using the object identifier.

10. (Withdrawn) An article of manufacture comprising a program storage medium readable by a computer and embodying one or more instructions executable by the computer to perform a method for preparing a user session for expiration, the method including:

*Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006*

detecting an impending expiration of the user session;
traversing an object graph corresponding to the user session to locate user session objects;
for each object located in the traversing, identifying allocated resources of the object; and
for each identified allocated resource, deallocating said allocated resource.

11. (Withdrawn) The article of manufacture as set forth in claim 10, wherein the identifying includes:

identifying resources selected from a group consisting of file handles, database connections, sockets, and threads.

12. (Withdrawn) The article of manufacture as set forth in claim 10, wherein the traversing, locating, identifying, and deallocating is completed prior to execution of a garbage collection algorithm performed preparatory to expiration of the user session.

13. (Withdrawn) The article of manufacture as set forth in claim 10, wherein the one or more instructions are encoded as one of:

Java bytecodes,
C# intermediate language (IL) code,
A compiled Java program, and
a compiled C# program.

14. (Withdrawn) The article of manufacture as set forth in claim 10, wherein the traversing of the object graph includes:

obtaining an enumeration of user session objects; and
looping through the enumeration of user session objects.

15. (Currently Amended) A system comprising:
a software program configured to initiate, process, and terminate user sessions;

*Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006*

an object graph defining an interrelationship between objects of said user session;
a resource deallocation module linked to the software program to deallocate
allocated external resources of each object of a user session responsive to an impending
termination of said user session; and

an automatic memory management garbage collector module invoked subsequent
to the deallocation performed by the resource deallocation module.

16. (Original) The system as set forth in claim 15, further including:
a Java virtual machine implementing the software program, the resource
deallocation module, and the automatic memory management module.

17. (Original) The system as set forth in claim 15, wherein the resource
deallocation module includes:

a deallocation listener method adapted to deallocate the allocated external
resources of each object of said user session responsive to a notification of the impending
termination of said user session.

18. (Original) The system as set forth in claim 17, wherein the resource
deallocation module is linked to the software program by registration of the deallocation
listener method with said user session.

19. (Original) The system as set forth in claim 17, wherein the resource
deallocation module is linked to the software program by an assignment of an attribute of
said user session to the deallocation listener method.

20. (Previously Presented) The system as set forth in claim 15, wherein the
resource deallocation module is adapted to access the object graph to identify the objects
of the user session.

21. (Original) The system as set forth in claim 15, wherein the automatic

Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006

memory management module is invoked by the software program to process a plurality of user sessions including said user session.

22. (Original) The system as set forth in claim 15, wherein the automatic memory management module is invoked by an operating system to process software including said software program that operate under said operating system.

23. (Original) The system as set forth in claim 15, wherein the resource deallocation module is integrated with the automatic memory management module as a single unitary memory management unit that executes prior to the termination of said user session.

24. (Currently Amended) An article of manufacture comprising a program storage medium readable by a computer and embodying one or more instructions of a resource allocation module executable by the computer to perform a method of releasing resources of a user session operating in a software environment that includes an automatic memory management algorithm executed by a garbage collector, the method comprising:
using the resource deallocation module, detecting an impending execution of the automatic memory management algorithm;
responsive to the detecting, accessing, by the resource deallocation module, an object of the user session and traversing an object graph;
identifying, by the resource deallocation module, one or more external resource references of said object;
using the resource deallocation module, releasing said one or more external resource references by a set of rules for said object; and
repeating the accessing, identifying, and releasing, by the resource deallocation module, for each object of the user session.

25. (Previously Presented) The article of manufacture as set forth in claim 24,

*Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006*

wherein the method further includes:

performing the accessing, identifying, releasing, and repeating as a Listener method belonging to a Java MyListener class in a Java environment; and
registering the Listener method with the user session.

26. (Previously Presented) The article of manufacture as set forth in claim 25, wherein the registering includes:

setting a session attribute to correspond to an instance of the Listener method.

27. (Previously Presented) The article of manufacture as set forth in claim 25, wherein the detecting includes:

notifying the registered Listener method of the impending expiration of the user session.

28. (Previously Presented) The article of manufacture as set forth in claim 24, wherein the detecting includes:
detecting an impending expiration of the user session.

29. (Previously Presented) The article of manufacture as set forth in claim 24, wherein the accessing, identifying, releasing, and repeating is performed prior to the execution of the automatic memory management algorithm.

30. (Previously Presented) The article of manufacture as set forth in claim 24, wherein:

the identifying includes identifying a file resource; and
the releasing includes closing said file resource.

31. (Previously Presented) The article of manufacture as set forth in claim 24, wherein:

*Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006*

the identifying includes identifying an allocated resource; and
the releasing includes deallocating the allocated resource.

32. (Previously Presented) The article of manufacture as set forth in claim 24, wherein the accessing of an object of the user session includes:

obtaining an object identifier corresponding to said object from the object graph; and
retrieving said object using the object identifier.

33. (New) The method as set forth in claim 1, further including:
identifying said object of the user session; and,
determining an object type of said object.

34. (New) The method as set forth in claim 33 wherein said releasing includes releasing said one or more external resource references by a set of rules for said object, including rules based on said object type.

35. (New) The method as set forth in claim 1, wherein said one or more external resource references are associated with at least one of file handles, database connections, sockets, and threads.

36. (New) A method in a resource deallocation module of releasing resources of a user session operating in a software environment that includes an automatic memory management algorithm executed by a garbage collector, the method comprising:

using the resource deallocation module, detecting an impending execution of the automatic memory management algorithm;

responsive to the detecting, accessing, by the resource deallocation module, an object of the user session;

identifying, by the resource deallocation module, one or more external resource references of said object;

*Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006*

using the resource deallocation module, releasing said one or more external resource references by a set of rules for said object; and
repeating the accessing, identifying, and releasing, by the resource deallocation module, for each object of the user session.

37. (New) The method as set forth in claim 36, further including:
identifying said object of the user session; and,
determining an object type of said object.

38. (New) The method as set forth in claim 37 wherein said releasing includes releasing said one or more external resource references by a set of rules for said object, including rules based on said object type.

39. (New) A system comprising:
a software program configured to initiate, process, and terminate user sessions;
a resource deallocation module linked to the software program to deallocate allocated external resources of each object of a user session responsive to an impending termination of said user session; and
an automatic memory management garbage collector module invoked subsequent to the deallocation performed by the resource deallocation module.

40. (New) An article of manufacture comprising a program storage medium readable by a computer and embodying one or more instructions of a resource allocation module executable by the computer to perform a method of releasing resources of a user session operating in a software environment that includes an automatic memory management algorithm executed by a garbage collector, the method comprising:
using the resource deallocation module, detecting an impending execution of the automatic memory management algorithm;

*Application No. 10/628,738
Amendment dated January 19, 2007
Reply to Office Action of November 21, 2006*

responsive to the detecting, accessing, by the resource deallocation module, an object of the user session;

identifying, by the resource deallocation module, one or more external resource references of said object;

using the resource deallocation module, releasing said one or more external resource references by a set of rules for said object; and

repeating the accessing, identifying, and releasing, by the resource deallocation module, for each object of the user session.

41. (New) The article of manufacture as set forth in claim 40, wherein the method further includes:

identifying said object of the user session; and,
determining an object type of said object.

42. (New) The article of manufacture as set forth in claim 41, wherein the method further includes releasing said one or more external resource references by a set of rules for said object, including rules based on said object type.